

***United States Court of Appeals  
for the Second Circuit***



**PETITION FOR  
REHEARING  
EN BANC**



ORIGINAL

76-7490  
76-7514

---

**United States Court of Appeals**

For the Second Circuit

EUTECTIC CORPORATION,  
NEW METALS CORPORATION and  
METALLIZING COMPANY OF AMERICA, INC.,  
*Plaintiffs-Appellees  
and Cross-Appellants,*

v.

METCO, INC.,  
*Defendant-Appellant  
and Cross-Appellee.*

---

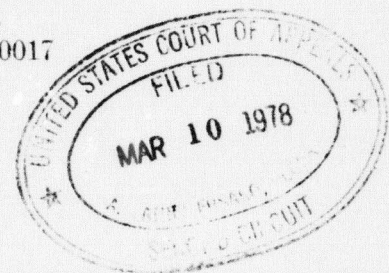
**PETITION FOR REHEARING AND  
SUGGESTION FOR REHEARING IN BANC  
BY  
PLAINTIFFS-APPELLEES AND CROSS-APPELLANTS**

---

JOHN M. CALIMAFDE  
*Attorney for Plaintiffs-Appellees  
and Cross-Appellants*  
60 East 42nd Street  
New York, New York 10017  
(212) 986-2480

*Of Counsel:*

EUGENE J. KALIL  
MARVIN N. GORDON  
HOPGOOD, CALIMAFDE, KALIL,  
BLAUSTEIN AND LIEBERMAN  
60 East 42nd Street  
New York, New York 10017



## TABLE OF CONTENTS

	<u>Page</u>
I Reasons for Granting the Petition and Suggestion.....	1
The Confusion of This Court in Reading the Diagram.....	5
This Court's Substitution of Its Own Interpretation of the Phase Diagram is Contrary to the Proper Scope of Appellate Review.....	8
II The Court Disregarded the Basic Rule of Claim Construction When it Construed the Claims Broadly for Infringement but Narrowly for Validity.....	10
III This Court Has Granted a Monopoly to Metco which the Patent Office Refused to Grant.....	11
Comment on Specific Statements in the Decision.....	13
Conclusion.....	15

## APPENDICES

Affidavit of Dr. Henry R. Hausner.....	A
Affdiavit of Dr. Harold Margolin.....	B
Affidavit of Herbert H. Kellogg.....	C
Affidavit of Dr. Walter Shepherd Owen.....	D
Phase Diagram Colored.....	E
Specific Reply to Footnotes in Court's Decision...	F

TABLE OF AUTHORITIES

	<u>PAGE</u>
Besser Manufacturing Co. v. United States, 343 U.S. 444 (1925).....	8
Fife Manufacturing Company v. Stanford Engineering Co., 299 F.2d 223 (7 Cir. 1962).....	11
Hollis v. Smith, Slip Opinion, 1653-54, February 17, 1978.....	3
International Boxing Club v. United States, 358 U.S. 242 (1959).....	8
Orvis v. Higgins, 180 F.2d 537 (2 Cir. 1950).....	9
Poller v. Columbia Broadcasting System, 368 U.S. 464 (1962).....	9
Skirow v. Roberts Colonial House, Inc., 361 F.2d 388 (7 Cir. 1966).....	11
United States v. Aluminum Company of America, 148 F.2d 416 (2 Cir. 1940).....	9
United States v. General Dynamics Corp., 415 U.S. 486 (1974).....	9
White v. Dunbar, 119 U.S. 47 (1886).....	11
Zenith Radio Corp. v. Hazeltine Research, Inc., 395 U.S. 100 (1969).....	8

PETITION FOR REHEARING  
AND SUGGESTION FOR REHEARING  
IN BANC BY  
PLAINTIFFS-APPELLEES

The plaintiffs-appellees and cross-appellants, Eutectic Corporation et al, respectfully petition this Court pursuant to Fed.R.App.P. 40(a) for a rehearing of its Decision and Opinion of February 6, 1978.

After a 14-day bench trial generating over 2300 transcript pages and over 105 exhibits, including testimony from five expert witnesses in the field of metallurgy, the District Court (Neaher, J.) in a detailed analysis of the evidence, found the patents valid but not infringed in an 85 page opinion (JA 16-100).

I

Reasons for Granting the  
Petition and Suggestion

The reversal of Judge Neaher's finding of non-infringement resulted from this Court's own interpretation of a phase diagram, a highly technical document which the Court saw as the "key" to its determination.

The errors committed by this Court are:

1. It assumed it was competent to interpret this highly technical document;
2. It misinterpreted this document and reached a conclusion that is fundamentally and scientifically wrong; and

3. Because of this wrong conclusion, it misconstrued the patent claims and extended the patent monopoly into an area expressly interdicted by the Patent Office before granting the patents in suit.

The substance of this Court's holding is gleaned from the following statements:

"Unquestionably, when the decision of the court below rests upon an incorrect reading of an undisputed document, this court is free to substitute its own reading of the document. Orvis v. Higgins, 180 F.2d 537, 539 (2d Cir.), cert. denied, 340 U.S. 810 (1950)." (Slip Opinion 6562)

The Court relied upon its own erroneous reading of the phase diagram to reverse the trial court and arrive at its conclusion of infringement:

"Essential to the determination of the necessary percentage of aluminum required for the appropriate production of heat is a certain phase diagram,\*\*\*, the court below erroneously concluded from the diagram that a minimum of 10% by weight of aluminum was required for there to be any interaction resulting in the formation of an intermetallic compound releasing the necessary heat. However, examination of the phase diagram itself reveals that there was confusion below between the weight and atomic percentages and that, in fact, according to the diagram, such an effect will occur with only 5% aluminum by weight." (Slip Opinion 6561)

The fact, however, is that there was no confusion in the trial court's understanding of the phase diagram based on the experts' interpretation of this highly technical document, but it was this Court, concluding that it was competent to read the diagram, that misapprehended its meaning. In so doing, this Court has reached a conclusion of metallurgy which is demonstrably wrong.

A lay-person cannot read the phase diagram; a proper reading requires a scientific background and experience. Any controversy as to what the phase diagram means was resolved by the trial court and, unless the trial court's interpretation is clearly erroneous, which it is not, the judgment should not be reversed. Indeed, if after consideration of this Petition, there remains any question regarding the correct interpretation of the phase diagram, the matter should be remanded for a finding as to the trial court's interpretation of the diagram.

This Court's substituted lay-reading of the diagram for the factual finding of the trial court is so clearly mistaken and so contrary to the basic principles of metallurgy and phase diagram interpretation, that we have felt compelled to append hereto affidavits<sup>1</sup> from four eminent scientists of international reputation who have worked with, prepared and analyzed many phase diagrams and therefore possess the high professional competency necessary to undertake their interpretation. Each attests to the fact that no significant or meaningful intermetallic reaction occurs or can occur in a flame spray with only 5% by weight of aluminum, and that at least 10% by weight and preferably more is required, exactly as found by the trial court. Dr. Hausner, Appendix A, also indicates that skill and experience are required to interpret the phase diagram.

These affidavits are submitted merely to illustrate that the reading of the phase diagram is not within the grasp of the lay-person but requires scientific knowledge and experience, and

---

1. Attached hereto as Appendices A,B,C, and D.

that this Court's interpretation of the phase diagram is in error. Information not originally available to the Court may and should be considered by it in determining the appropriateness of the relief originally ordered. There was, of course, no way to predict that this Court would have considered itself competent to read and attempt to interpret the phase diagram. See, e.g., Hollis v. Smith, (2d Cir.), opinion partially granting petition for rehearing granted February 17, 1978, Slip Opinion 1653-54.

The trial court found that at least 10% by weight of aluminum was required to produce the additional heat by the interaction of the metals; this was "clearly" a "factual finding."<sup>1</sup> The accused powder used less than half of the patents' specified minimum, i.e., 5% by weight of aluminum, and the District Court also found that "the evidence at trial convincingly established that the formation of an intermetallic compound as a heat generating mechanism could not be accomplished when only 5% by weight of aluminum powder is used, as in the accused powders" (JA 83-85). When only 5% by weight of aluminum was employed in the accused powders, the additional heat under flame spray conditions was generated by the oxidation of aluminum (not by the interaction of the metals).

The Confusion of This  
Court in Reading the Diagram

We can only surmise the reasoning which led this Court to believe it could accurately read the phase diagram and reach a conclusion based on such reading. Apparently, this Court simply followed the phase line to its terminal point at 5% by weight aluminum and concluded that at that point one could obtain an intermetallic compound. Since Judge Neaher had found that an inter-

---

1. Slip Opinion, page 6559

metallic occurred at a minimum of 10% by weight of aluminum, this Court jumped to the conclusion that Judge Neaher had simply read the atomic percentage scale rather than the weight scale, both of which appear on the diagram. It is clear, however, from the record and from the carefully written decision of Judge Neaher that when he found non-infringement he was reading the weight scale and not the atomic percentage scale.

For the Court's assistance in reading the phase diagram, we offer the following explanation. The phase diagram<sup>1</sup> shows a temperature scale along the left-hand side in degrees centigrade, with the weight percentage of nickel along the top of the diagram and the atomic percentage of nickel along the bottom of the diagram. The percentage of aluminum along both scales is simply the nickel percentage shown subtracted from 100%. The phase line, colored red, is a trace of melting points for various nickel-aluminum compositions ranging from 0% to 100% nickel.

The phase line starts at the left-hand side of the diagram at 660°C; we have marked this point with the letter "A". This means that a composition having 0% nickel (or 100% aluminum) will

---

1. Appended hereto as Appendix E.

have a melting point of 660°C; that is simply the melting point of aluminum. As more nickel is added to the composition the melting point initially decreases, and then increases until a maximum melting temperature of 1638°C is reached for the composition having 68% nickel and 32% aluminum (Point B). Thereafter, the melting point of the composition decreases as the weight percentage of nickel increases until about 1385°C for the composition ranging from about 87% to 89% nickel and 13% and 11% aluminum (Point C). The melting point then increases with increasing amounts of nickel until the composition has 0% aluminum or 100% nickel for which the melting point is 1453°C (Point D). The diagram also shows, as a band, that the nickel aluminide intermetallic  $\text{Ni}_3\text{Al}$  (the only intermetallic of interest here because of the low weight percentage of aluminum) is formed in the region of Point C.

From about Point C, a phase line is seen extending into the lower temperature region to room temperature where the line approaches 5% by weight of aluminum; we have colored this line yellow. To the right of this line in the diagram, the material is essentially nickel. The apparent source of the Court's confusion is that it assumed that the intermetallic occurred at the lower temperature part of this line; i.e. from room temperature to about 600°C, where the line approaches 5% by weight of aluminum. That is incorrect. In that low

temperature region, indeed from below 1385°C, the material is solid and the significance of the line as it approaches 5% aluminum at low temperatures is completely meaningless insofar as flame spray reactions are concerned.<sup>1</sup>

The flame necessarily is at a high temperature, exceeding 2000°C, causing the two metals to melt together and thereby interact, and thereafter to produce the exothermic intermetallic reaction ('515 Patent, col 3, lines 41-47); and as can be seen in the diagram, the reaction occurs for the intermetallic at about 1385°C (Point C) where the weight of aluminum exceeds 10%, exactly as found by the District Court.

Manifestly, the diagram is not self-explanatory, but is highly complex, and it was clearly erroneous, we submit, for this Court to conclude that it was competent to read this diagram. There was substantial testimony below regarding the meaning of the diagram, indeed, even Metco could not agree on the validity of the diagram to interpret flame spray reactions (JA-89), and the controversy was resolved by the

- 
1. As this Court recognized, essential to the result of bonding is that the two metals are "heated to a reaction point [the temperature at which the two metals are melted together] by the flame spray gun thereafter interacting to form the intermetallic compounds, and, in the process, giving off heat." Manifestly, the reaction point or the melting point of the two metals is not at room temperature where 5% by weight of aluminum appears in the diagram and clearly, the metals do not interact at room temperature to generate additional heat. If the metals interacted at room temperature, they would react in the container; needless to say, they do not.

trial court in a factual finding of non-infringement. After presuming the technical competence to read the diagram, this Court then compounded the error by misapprehending it and reversing a technologically sound determination by substituting a holding that is scientifically wrong.

This Court's Substitution  
of Its Own Interpretation  
of the Phase Diagram is  
Contrary to the Proper  
Scope of Appellate Review

The scope of appellate review of issues of fact, particularly in complex cases, is exceedingly narrow, placing on one seeking to overturn findings of fact "an almost insurmountable burden." International Boxing Club v. United States, 358 U.S. 242, 252 (1959); Besser Manufacturing Co. v. United States, 343 U.S. 444, 446 (1952). The finding of fact of non-infringement based on the testimony of many ~~experts~~ and complex technical data is subject to the "clearly erroneous rule" of Fed.R.Civ.P. 52(a). In Zenith Radio Corp. v. Haseltine Research, Inc., 395 U.S. 100, 123 (1969), the Supreme Court admonished that under the "clearly erroneous" standard, appellate courts must be careful not to decide such factual issues de novo. See also, Poller v. Columbia Broadcasting System, 368 U.S. 464, 473 (1962); United States v. Aluminum Company of America, 148 F.2d 416, 433 (2 Cir. 1940); United States v. General Dynamics Corp., 415 U.S. 486, 508 (1974).

The decision by this Court first to presume the competence to read the highly complex technical document and then to substitute its own reading for a finding based on the overwhelming weight of evidence including testimony from several experts interpreting the document is contrary to all reported precedent. This Court justified its de novo fact finding by relying on the theory that an appellate court "is free to substitute its own reading of the document."<sup>1</sup> The case cited by the Court for authority, Orvis v. Higgins, 180 F.2d 537, 539 (2 Cir. 1950), is not applicable, as that case and the precedents cited in that case all involved documents which were self-explanatory or "self-speaking."

As can be understood from the record below, and from the attached affidavits, the reading of the highly technical nickel-aluminum phase diagram requires specialized skill and experience. It clearly is not a self-explanatory document, nor is it comprehensible to the lay-person. Indeed, the days which the experts devoted to an interpretation of the diagram and the controversy which emerged from the differing interpretations within Metco's own camp is an example of the sophistication required to understand the diagram.

---

1. Page 6562.

## II

### The Court Disregarded the Basic Rule of Claim Construction When it Construed the Claims Broadly for Infringement but Narrowly for Validity

---

This Court stated that the "percentage relationship of the components"<sup>1</sup> is the "key" to the "generation of heat" resulting from the interaction of the metals "to form intermetallic compounds."<sup>2</sup> Claim 14 does not specify either the percentage relationship of components, or that the generation of heat is the result of the interaction of metals to form the intermetallic compounds. That is why the District Court stated that if the claim is read literally, it is clearly anticipated and invalid (JA-79-80). To sustain the claim, the District Court read those key or critical limitations into the claim (JA-79-81). This Court affirmed the "well-reasoned determination of the court below" on the issue of validity.<sup>3</sup> In reversing the lower court to find infringement, however, this Court overlooked the critical limitations which the District Court found necessary to read into the claim in order that it may be sustained.

The District Court acknowledged that it was clearly improper and contrary to law to read a limitation into a claim to give it life, and then to read the limitation out of the claim to give it scope (JA-81). (That is precisely what this Court did). The District Court, therefore,

- 
1. Page 6557.
  2. Page 6555.
  3. Page 6559.

found no infringement because the accused powder does not employ that percentage relationship of components which is critical for the generation of additional heat resulting from the interaction of the metals.

The inconsistent claim construction by this Court is contrary to every reported decision on the proposition, and should be rectified by the Court. The claims are either invalid or not infringed depending on whether the limitations are read into the claim or not. But most assuredly, the limitations may not be read into the claim for purposes of validity and read out of the claim for purposes of infringement. See, e.g., White v. Dunbar, 119 U.S. 47, 51-2 (1886); Skirow v. Roberts Colonial House, Inc., 361 F.2d 388, 391 (7 Cir. 1966); Fife Manufacturing Company v. Stanford Engineering Co., 299 F.2d 223, 226 (7 Cir. 1962).

### III

This Court Has Granted a  
Monopoly to Metco which the  
Patent Office Refused to Grant

The Patent Office refused to grant Metco a patent encompassing the heat generating mechanism resulting from the oxidation of aluminum which occurs when only 5% of the aluminum is used in the powder (the accused powder). The

1  
prior patents disclose the use of aluminum in a flame spray powder for its exothermic properties. Indeed the Patent Office rejected the application several times on that ground. In response, Metco expressly disclaimed any proprietary rights to the exothermic reaction resulting from the oxidation of aluminum when it told the Patent Office:

"\*\*\* (the) entire point of novelty is the formation of flame spray composite with the specific selection of components' which are capable of 'exothermically reacting by forming an intermetallic compound,' and it is necessary 'that the relative proportions of the (components) are capable of reacting together to form the intermetallic compound. Proportions which will not so react are, of course, not included within the scope and terminology of the claims.'" (JA-85)

Metco could not make it more plain; its "invention" resided in powders having those relative proportions of components that will react to generate heat by forming the intermetallic compound. Those which will not so react are admittedly not included within the scope of the patent. It is difficult to perceive how a patentee can make it more clear that the aluminum oxidizing reaction of Eutectic's powder (i.e. 5% aluminum) does not come within the scope of the patent.

Indeed, even on the face of the patent, Metco disclaimed

---

1. JA 48-50

any rights to the exothermic reaction resulting from the oxidation of aluminum.<sup>1</sup>

Thus, the oxidation reaction in flame spray powders concededly was in the prior art and free for the public to use until the decision by this Court. Metco now (if the decision is permitted to stand) is the beneficiary of a broadened monopoly which admittedly it was not entitled to and could not obtain from the Patent Office.

Comment on Specific  
Statements in the Decision

Several of the footnotes in this Court's decision explain the bases for this Court's reversal of the lower court's judgment. The bases are either misapprehensions of the record or of the technology involved. In order to be as complete as possible, we have prepared a detailed reply in Appendix F to this brief. One statement appearing at page 6561, however, requires special reply. The Court stated that "Dr. Grant conceded that 5% by weight according to the phase diagram could not only cause a reaction releasing more than the minimum requirement of heat but also form some inter-metallic compound." The Court erroneously construed Dr. Grant's testimony.

---

1. See, e.g., '515 patent, column 6, lines 6-11, reading

"In combining, in the exothermic reaction, forming the intermetallic compound, the components generate heat in situ in the actual material which is to form at least a part of the coating. This is to be distinguished from flame spray processes and materials in which heat is generated by a reaction, such as oxidation reaction,\*\*\*."

The Court quoted an answer of Dr. Grant (footnote 13) indicating that the 5% aluminum mixture will generate 4000 calories per gram atom, "with reference to room temperature." The Court then stated, "This testimony is significant in view of the fact that 'the '515 patent states that '[t]he components should release [at least] 3000 calories per gram atom...". The comparison made by the Court cannot accurately or meaningfully be made.

A caloric output "with reference to room temperature" is a complicated mathematical determination which has nothing whatever to do with the actual release of heat under flame spray conditions. Obviously, the metal components do not generate heat at room temperature. Reference to room temperature is used by scientists as a standard in comparing reactions of different materials, but the specific number "referenced to room temperature" cannot be correlated with the actual heat release at the reaction temperature. The statement in the patent to which this Court refers is the caloric output for the two metals when they are melted together ('515 patent, col.3, lines 41-50). Thus, clearly Dr. Grant made no concession that 5% by weight of aluminum could cause a reaction releasing more than the minimum requirement of heat. This Court has simply misunderstood the technical significance of his testimony.

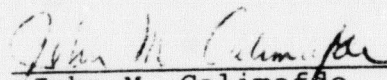
Further, in regard to the statement that Dr. Grant conceded that with 5% by weight of aluminum "some inter-metallic compound" will be formed, Dr. Grant was asked whether "it is possible for the aluminum to start to react

with the surface of the nickel exothermically and form into an intermetallic compound?" To which Dr. Grant answered, "Yes, it may form a thin film of it." The conservative answer that it is possible that a thin film of intermetallic may be formed is hardly a concession, in the context of the entire record which established beyond doubt by laboratory test data, photomicrographs, theoretical explanations, and found as a fact by the District Court, that at least 10% by weight of aluminum was required for the metals to interact and form the intermetallic compound (JA 82-89).

#### CONCLUSION

The Court should grant this Petition for Rehearing and upon such Rehearing, the judgment of the District Court finding no infringement should be affirmed, or alternatively, the matter relating to infringement should be remanded to the District Court with instructions to make supplemental findings specifically as to its reading of the phase diagram or to take such other steps as it deems appropriate. 28 U.S.C. §2106.

Respectfully submitted,

  
\_\_\_\_\_  
John M. Calimafde  
Attorney for Plaintiffs-Appellees  
and Cross-Appellants  
60 East 42nd Street  
New York, N. Y. 10017

#### Of Counsel:

Eugene J. Kalil  
Marvin N. Gordon  
Hopgood, Calimafde, Kalil,  
Blaustein & Lieberman



STATE OF NEW YORK

ss:

COUNTY OF NASSAU

AFFIDAVIT OF HENRY H. HAUSNER

HENRY H. HAUSNER, being duly sworn, deposes and says as follows:

1. I hold advanced degrees in engineering, including an Electrical Engineering degree (1925) from the Technical University of Vienna, Austria, and a Doctor of Engineering degree from the same university (1938); I have been active for many years in the field of metallurgical engineering as an educator, as a scientist with various corporations in both the research and executive capacity and as an industrial consultant; I am an honorary professor of powder metallurgy at the Polytechnical Institute of New York, a visiting professor at the Max Planck Institute of Germany (1971); I have lectured in the powder metallurgical field at NYU and UCLA, and have lectured on powder metallurgy at the Olivetti Technological Institute of Italy since 1967.

2. I am a registered Professional Engineer of the State of New York and am a member of the following technical societies the American Institute of Mining and Metallurgical Engineers, the American Powder Metallurgy Association, the International Plansee Society of Powder Metallurgy, the American Society of Metals, and am an honorary member of the Powder Metallurgy Association of India; and the recipient of the Powder Metallurgy Achievement Award from the Stevens Institute of Technology (1956).

3. I have given many lectures in the field of metallurgy, particularly powder metallurgy, throughout the world and have authored and co-authored the following publications: Powder Metallurgy (1947), the Physics of Powder Metallurgy (1951), Materials for Nuclear Powder Reactors (1955), Metal Beryllium (1955), Metallurgy of Zirconium (1955), New Types of Metal Powders (1964), Handbook of Powder Metallurgy (1973) and many other publications too numerous to mention.

4. I have worked on diffusion problems relating to the aluminum-nickel system and am, therefore, very familiar with the aluminum-nickel phase or equilibrium diagram, a copy of which is attached hereto as Exhibit A.

5. The phase diagram (Exhibit A) provides information regarding the several phases of nickel and aluminum formed at the different temperatures, and indicates the amount of nickel and aluminum required to produce the various microstructures which occur at the specified temperatures and compositions. A reading of the phase diagram requires scientific training and specialized skills in this field.

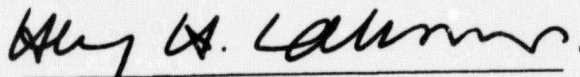
In reading the phase diagram (Exhibit A) in conjunction with temperature conditions inherent in flame spray technology of nickel-aluminum, only the applicable high temperature portion of the diagram is meaningful; in this case, in the region of about 1385°C. Examination of the phase diagram at temperatures significantly below the aforementioned temperature and particularly at room temperature, is meaningless with respect to the problems of flame spraying.

To determine the weight percentage of aluminum required to cause an intermetallic reaction, the diagram must be examined in the reaction temperature range. It would be wrong to examine it at room


temperature; indeed, it would be scientifically unsound to use the low temperature region of the phase diagram to determine the reactions which occur during flame spraying. A correct reading of the diagram indicates that at about 1385°C at least about 10% by weight of aluminum would be required to cause the intermetallic reaction to occur under flame spray conditions.

A powder consisting of aluminum coated nickel particles in amount of 5% by weight of aluminum, when subjected to a flame spray, would not produce a significant amount of intermetallic compound. On the contrary, any aluminum that combines with the nickel under flame spray conditions would form the alpha phase. Moreover, the reaction under flame spray conditions would result in the oxidation of aluminum. This is well known and experimentally established scientific fact. In my opinion, under no circumstances in a flame spray environment is there a significant stable intermetallic reaction where the powder contains 5% by weight of aluminum.

It would be wrong as a scientific fact to read the phase diagram to mean that an intermetallic is formed at 5% by weight aluminum at flame spray reaction temperatures. When the intermetallic exists at room temperature, it is the result of having been formed at an elevated temperature. As explained above, the intermetallic can only be formed at elevated flame spray reaction temperatures, provided that at least about 10% by weight of aluminum is present in the nickel-aluminum powder.

  
Henry H. Hausner

Sworn to before me this  
7<sup>th</sup> day of March, 1978

  
Samuel A. Hausner  
Notary Public,  
Notary Public, State of New York  
No. 30-0583325  
Qualified in Nassau County  
Certificate filed in New York County  
Commission Expires March 30, 1979

119

Al-Ni

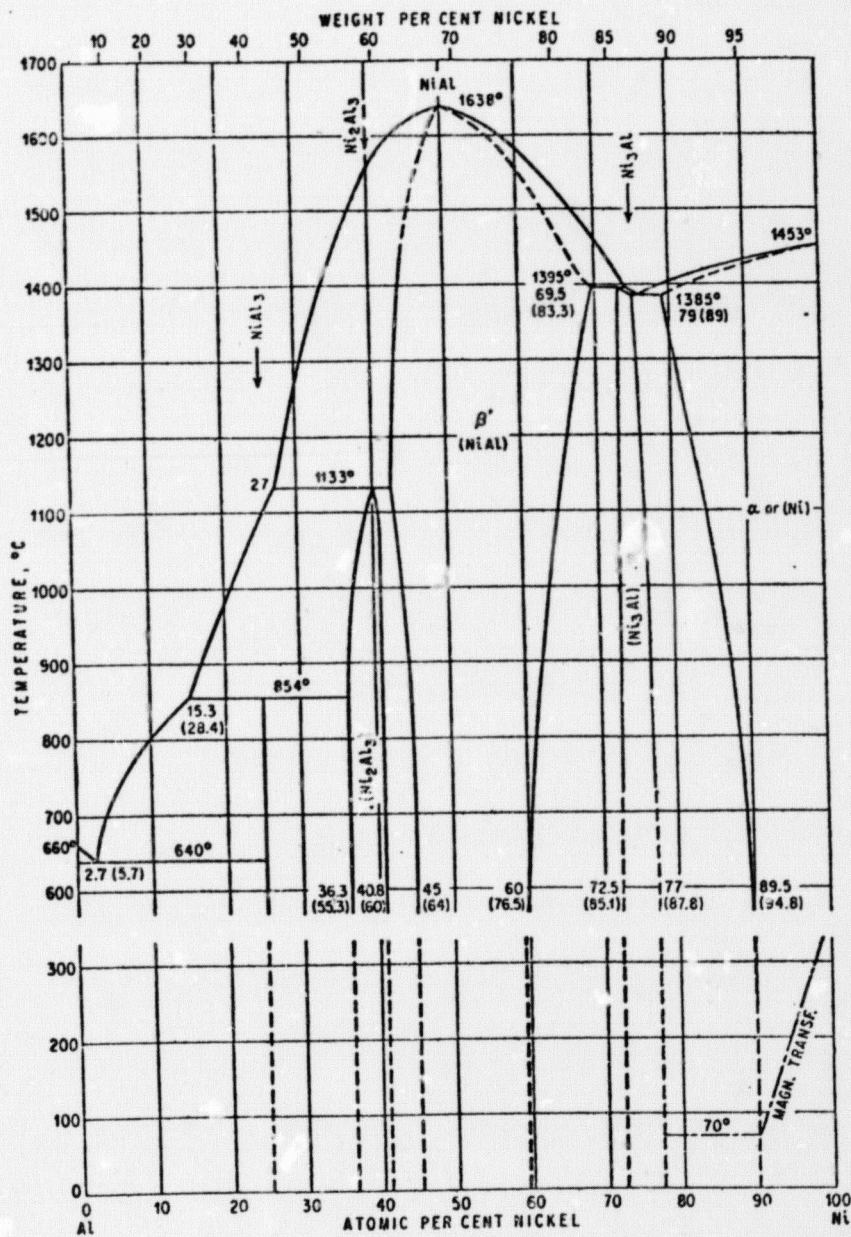


Fig. 68. Al-Ni. (See also Fig. 69.)

Exhibit A

STATE OF NEW YORK  
COUNTY OF NEW YORK

ss: B 1

AFFIDAVIT OF HAROLD MARGOLIN

HAROLD MARGOLIN, being duly sworn, deposes and says as follows:

1. I am a graduate of Yale University and hold the following degrees from that institution: B. Eng. 1943, M. Eng. 1947 and D. Eng. 1950; I have been a Research Associate and Research Scientist at New York University from 1949 to 1956 and since this period I have been a professor of metallurgical engineering at New York University and the Polytechnic Institute of New York where I now hold the position of professor of Physical and Engineering Metallurgy.

2. I have been a consultant to many national corporations: have given lectures at national meetings of the American Institute of Mining and Metallurgical Engineers, American Society of Metals, and have participated in a number of international meetings at which I presented technical papers in the field of metallurgy; and have also given talks by invitation at a number of universities and industrial laboratories.

3. I am a member of the American Society of Mining and Metallurgical Engineers (AIME), American Society of Metals (ASM), Sigma Xi, and the American Association for the Advancement of Science; I have been honored by being elected as a Fellow of The American Society for Metals; I have chaired and have been a member of many committees of the AIME and ASM.

4. I have published over sixty (60) technical papers, fifteen (15) of which are concerned with phase diagrams and much of my work has been included in standard reference books on phase diagrams.

5. A phase diagram is essentially a temperature-composition map which defines the temperature and composition range over which phases exist. One must have appropriate scientific background in order to interpret phase diagrams.

6. I am familiar with the nickel-aluminum phase diagram (Exhibit A attached) and, if one examines this diagram with respect to flame spray conditions, it is clear that in the region of about 1385°C, one must exceed about 10% by weight aluminum before the intermetallic compound  $\text{Ni}_3\text{Al}$  will form. At temperatures above about 1385°C, an alloy of 10% by weight aluminum will melt and eventually the alloy will be completely molten with increased temperature. If the Ni-Al mixture containing less than about 10 wt.% of aluminum were to become molten as a result of flame spraying, it would not be expected that significant amounts of  $\text{Ni}_3\text{Al}$  would form on cooling from the molten state to the aforementioned temperature and, therefore, amounts in excess of 10 wt.% would be required to form significant amounts of  $\text{Ni}_3\text{Al}$  in the region of about 1385°C.

Under flame spray conditions, the metal powders of Ni-Al are heated to high temperatures and consequently it is the high temperature region of the diagram which must be used to interpret what phases will be present by reaction.

Temperatures below 600°C are not applicable to interpret phase equilibrium under flame spray conditions. Furthermore, it must be pointed out that, because aluminum has a high affinity for

oxygen, some of the aluminum originally on the surface of the nickel particles prior to introduction into the flame must oxidize during flame spraying. Consequently, 10% by weight of aluminum originally present on the powder would not be available to form the  $\text{Ni}_3\text{Al}$  by reaction.

A powder containing 5% by weight aluminum would certainly not provide the intermetallic compound  $\text{Ni}_3\text{Al}$  by reaction at flame spray temperatures and, moreover, Exhibit A indicates that there is no significant possibility for the formation of  $\text{Ni}_3\text{Al}$  in the nickel-aluminum powder containing 5% by weight aluminum below  $600^\circ\text{C}$ . The phase diagram indicates that the boundary showing the limit of solubility of aluminum in nickel (alpha phase) asymptotically approaches 5% by weight aluminum at temperatures from  $300^\circ\text{C}$  to  $100^\circ\text{C}$ . Such a situation indicates that in all likelihood no  $\text{Ni}_3\text{Al}$  would be formed in the nickel-aluminum spraying system containing 5% by weight of aluminum.

In short, the low temperature portion of the phase diagram has no meaning insofar as flame spraying is concerned. It is the high temperature portion of the phase diagram that is important and this part of the phase diagram indicates that over about 10% by weight of aluminum should be present to assure formation of significant amounts of the intermetallic compound  $\text{Ni}_3\text{Al}$  under flame spray conditions.

Harold Margolin

Harold Margolin

Sworn to before me this  
6th day of March, 1978

Robert K. Kane

Notary Public

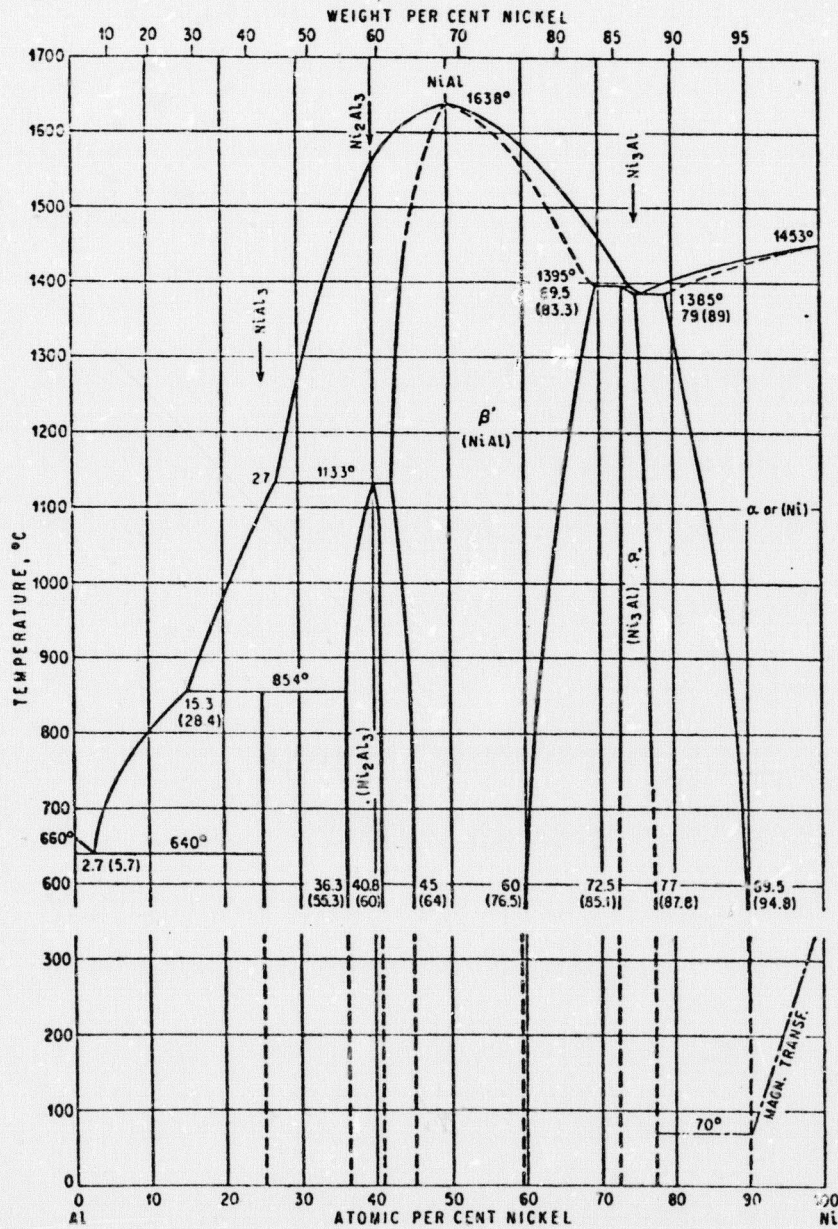


Fig. 68. Al-Ni. (See also Fig. 69.)

Exhibit A

STATE OF NEW YORK  
COUNTY OF NEW YORK ss:

AFFIDAVIT OF HERBERT H. KELLOGG

HERBERT H. KELLOGG, being duly sworn, deposes and says as follows:

1. I hold advanced degrees in metallurgy from Columbia University; I have been teaching metallurgy at the aforementioned university since 1946; I am presently the Stanley-Thompson Professor of Chemical Metallurgy; I have been continuously active in the metallurgical field as a research scientist, as an educator, as an industrial consultant to many corporations; I have served on many government committees; I have chaired a number of committees of the Metallurgical Society of the American Institute of Mining and Metallurgical Engineers; and I have served on various panels of the National Academy of Sciences since 1951.

2. I have received the following honors: the best paper award in 1961 given by the Extractive Metallurgical Division of AIME; appointment to the Stanley-Thompson Professorship of Chemical Metallurgy by the Trustees of Columbia University in 1968; election as "Fellow of the Metallurgical Society" of the AIME in 1972 in recognition of my many contributions to the understanding of the chemistry of metallurgical processes; and the James Douglas Gold Medal awarded by the AIME in 1973.

3. I have lectured widely in the United States and in foreign countries and have authored and co-authored many papers in the field of metallurgy in such publications as National Academy of Sciences, Journal of Metals, Transactions of the Metallurgical Society of the American Institute of Mining and Metallurgical Engineers, Proc. International Symposium on High Temperature Technology, Physical Chemistry of Process Metallurgy, Jour. Chem. Eng. Data, among others.

4. I am familiar with phase diagrams of many kinds, and with the aluminum-nickel phase diagram (attached hereto as Exhibit A) in particular. A phase diagram shows information on the nature and composition of the possible phases in a given system, and the various equilibria that can exist between these phases. Since temperature and overall system composition exert a profound influence on the composition of phases and the equilibria between phases, the common phase diagram displays this information by a diagram where temperature is the ordinate, and overall system composition is the abscissa. Interpretation of such phase diagrams requires scientific training, understanding of the phase rule, and the laws of thermodynamics.

In flame-spray technology, the particles of metal or alloy are heated by the flame to high temperatures so that the portion of the phase diagram that has meaning for this process is the higher temperatures shown in Exhibit A. Reading Exhibit A in the high temperature range, near the right-hand boundary, we may conclude that an overall composition containing less than about 10% by weight aluminum will consist entirely of the alpha solid solution, a liquid solu-

C 3

tion or a mixture of both, but no intermetallic, depending on the temperature reached during metal spraying.

None of the intermetallic phase,  $\text{Ni}_3\text{Al}$ , can exist in an equilibrium system unless the overall composition exceeds about 10 wt.% Al, for temperatures likely to exist in the flame during flame spraying.

That portion of the phase diagram below  $600^\circ\text{C}$  can have no scientific meaning for what can be expected to occur in a high temperature flame.

Flame spraying a powder that contains 5 wt.% aluminum (95 wt.% Ni), will not, therefore, result in the formation of the intermetallic phase  $\text{Ni}_3\text{Al}$ . It might result in formation of a non-intermetallic of the alpha solid solution or liquid solution, but the most likely result would be oxidation of the aluminum to aluminum oxide by reaction with the products of combustion of the flame.

Thus, the phase diagram considered for a flame spray reaction indicates that at least 10% by weight of aluminum would be required to produce the intermetallic reaction. Powder containing only 5% by weight of aluminum cannot and will not form any significant amount of intermetallic compound under flame spray conditions.

Herbert H. Kellogg

Herbert H. Kellogg

Sworn to before me this  
6th day of March 1978

Stromb G. G. G.  
Notary Public

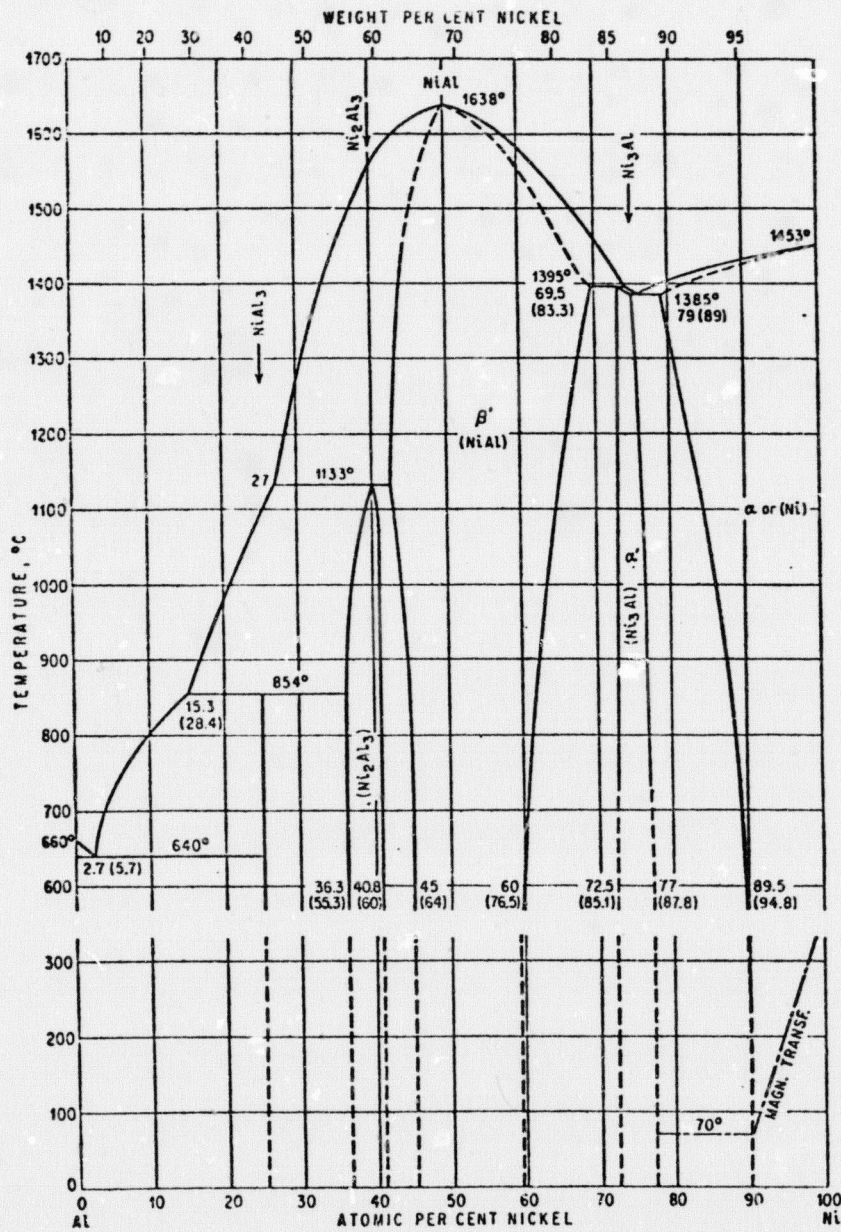


Fig. 68. Al-Ni. (See also Fig. 69.)

Exhibit A

COMMONWEALTH OF MASSACHUSETTS  
COUNTY OF MIDDLESEX

D 1  
ss.

AFFIDAVIT OF WALTER SHEPHERD OWEN

I, WALTER SHEPHERD OWEN, being duly sworn, depose and say as follows:

(1) I am professor of materials science and engineering at the Massachusetts Institute of Technology, Cambridge, Massachusetts.

(2) I have advanced degrees in metallurgy and engineering, a summary of my educational background being as follows: 1940, B. Eng., 1942, M. Eng., 1950, Ph.D., 1972, D. Eng. (honorary), all at the University of Liverpool, England.

(3) I have successively held positions as: Henry Bell Wortley Professor of Metallurgy, University of Liverpool; Thomas R. Briggs Professor of Engineering and Director of the Department of Materials Science and Engineering, Cornell University, Ithaca, New York; Dean of the Technological Institute, Northwestern University, Evanston, Illinois. Currently, I am Head of the Department of Materials Science and Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts.

(4) I am or have been a member of a number of government committees relating to metallurgy including: National Materials Advisory Board of the National Academies of Science and Engineering; New York State Engineering Education Resources Study Council; Scientific and Technological Aspects of Materials Processing in Space Committee of the Space Applications Board of the National Research Council.

(5) I am a member of numerous technical societies including: American Society for Metals; The Metallurgical Society, Institute of Metals Division, of the American Institute of Mining, Metallurgical and Petroleum Engineers; Sigma Xi; Institute of Metals; and the Institution of Metallurgists.

(6) I have authored and co-authored many papers in the field of metallurgy in such publications as Acta Metallurgica, Scripta Metallurgica, American Society of Metals, Metallurgical Transactions, Journal of the Japan Institute of Metals, among others, and have lectured widely in the United States and in foreign countries.

(7) I have received honors including election to the National Academy of Engineering and Fellow of the American Society for Metals.

(8) I am familiar with the nickel-aluminum binary phase diagram, a copy of which is attached as Exhibit A. This diagram is sometimes referred to as an equilibrium diagram or as a constitutional diagram. Its purpose is to define the ranges of temperature and chemical composition within which different phases of nickel-aluminum exist when equilibrium conditions have been established. To establish equilibrium at any temperature requires some time. The diagram is not concerned with phases which metals form during this period of transition towards equilibrium. It is concerned only with the phases existing after equilibrium has been established.

It is my opinion that in a flame-spray environment, the temperature range within which phases of nickel and aluminum need to be considered is between about 1300 and 1500°C. At tempera-

D 3

tures within this range, nickel and aluminum phases reach equilibrium rapidly. Thus, a mixture of 5% by weight of aluminum with nickel in a flame-spray environment will be the equilibrium phase. This phase is a solid solution, not a compound. No  $\text{Ni}_3\text{Al}$  intermetallic compound is likely to form under these conditions and, therefore, any heat generated by exothermic formation of  $\text{Ni}_3\text{Al}$  is insignificant.

While it is seen that the equilibrium line between the alpha solid solution and the  $\text{Ni}_3\text{Al}$  phase approaches 5% by weight of aluminum below  $600^\circ\text{C}$  and down to room temperature, it would be scientifically wrong to look at this portion of the diagram to interpret reactions which occur under the flame spray conditions. It is much more probable that aluminum oxidizes in the spray flame and that heat generated from this exothermic oxidation raises the temperature.

In order for significant amounts of  $\text{Ni}_3\text{Al}$  to be formed at flame spray temperatures, at least about 10% by weight of aluminum should be present in the mixture.

Walter S. Owen  
Walter S. Owen

Sworn to before me a notary  
this 23<sup>rd</sup> day of  
FEBRUARY, 1978

David J. Maunello  
Notary Public

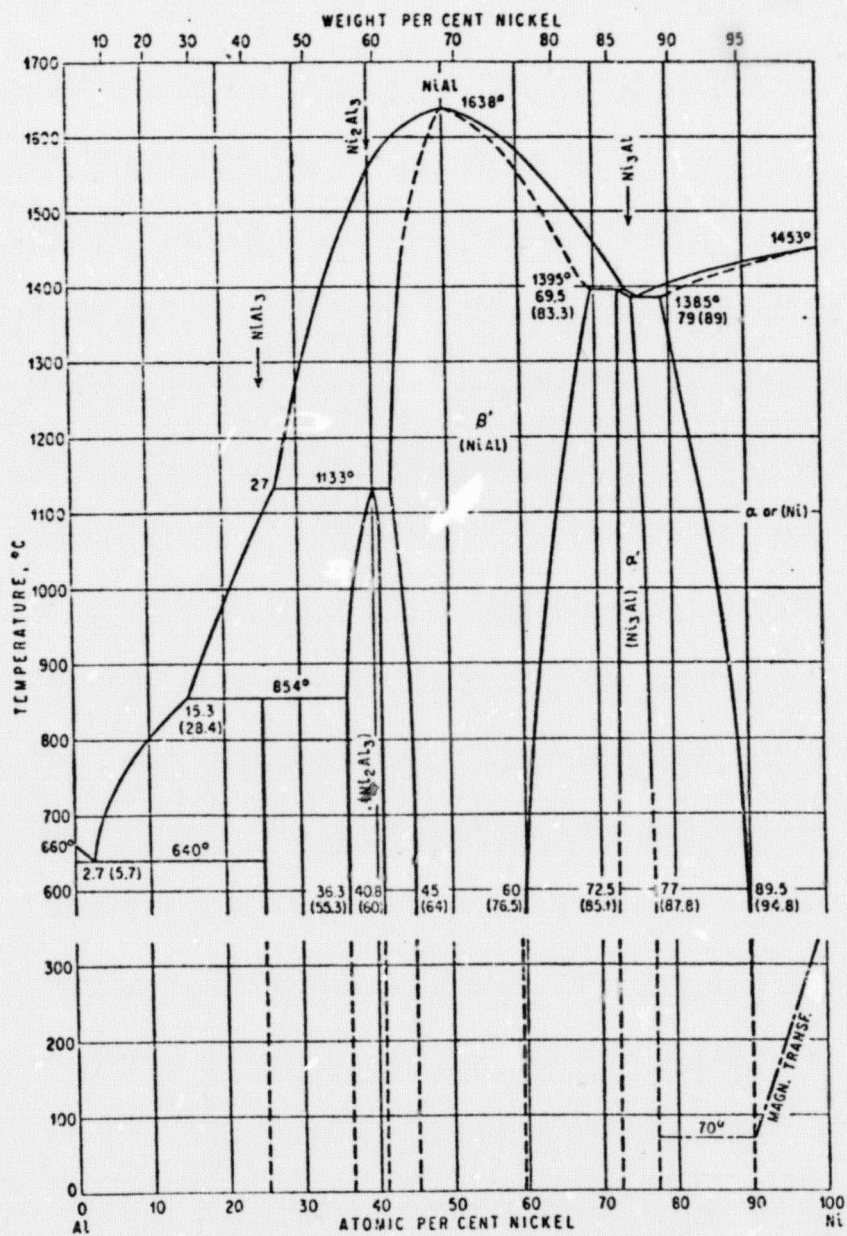


Fig. 6S. Al-Ni. (See also Fig. 69.)

Exhibit A

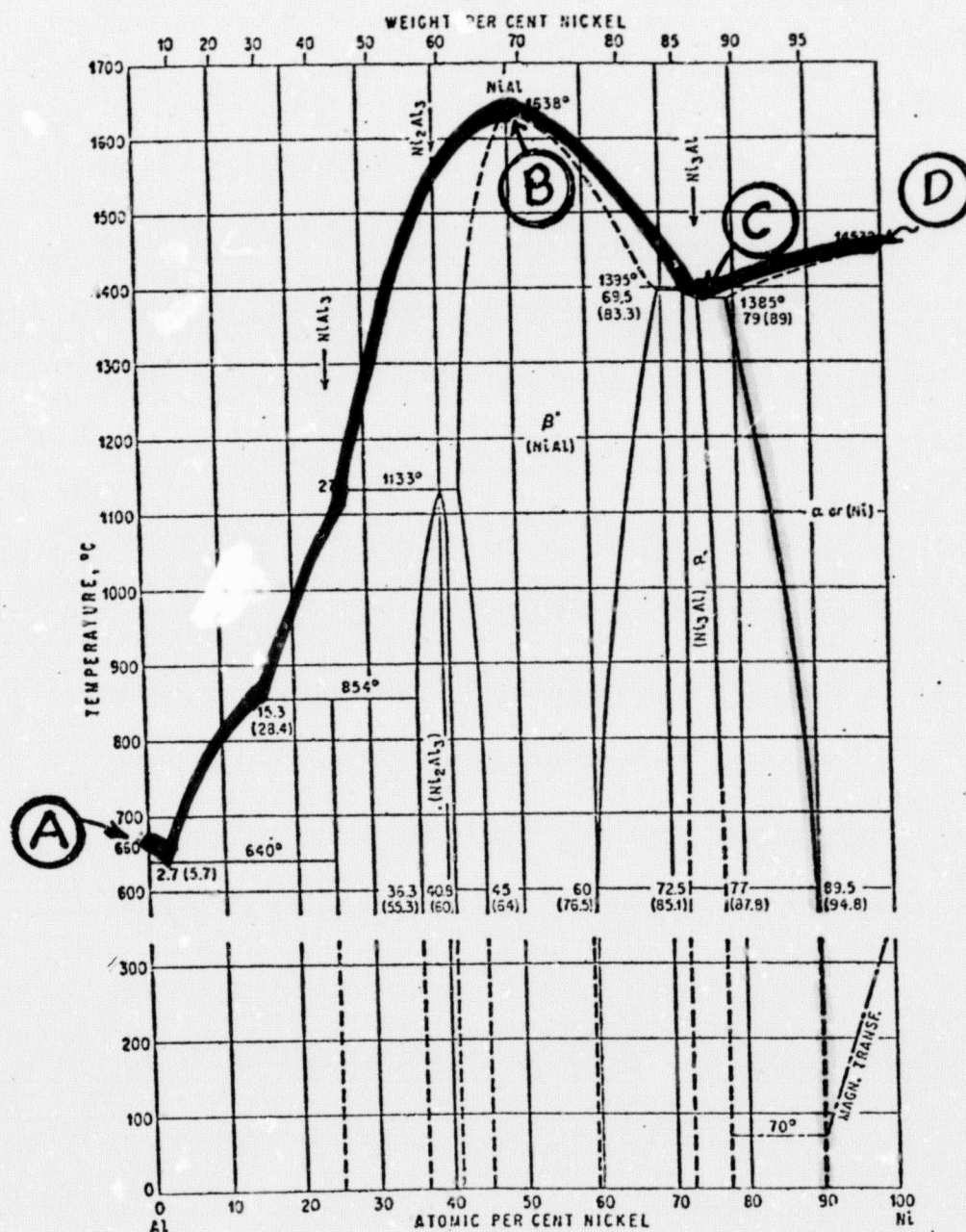


Fig. 6S. Al-Ni. (See also Fig. 6C.)

APPENDIX FSPECIFIC REPLY TO  
FOOTNOTES IN COURT'S DECISION

In footnote (8), this Court indicated that it agreed with the District Court that "one must focus primarily on the initial composition of the powders in question rather than upon the composition of the coating after spraying." The initial compositions as found by the lower court are critically different. Moreover, an examination of the coating after spraying resolves any ambiguity as to the starting composition, and more importantly, reveals whether the heat generating mechanism is oxidation (prior art) or the intermetallic reaction of the patent (JA-83). The patent specifies that the coating is a dense intermetallic of nickel and aluminum ('515 patent, Col. 7, lines 9-12). The extensive courtroom examination of all the experts on the nature of the sprayed coatings, as well as the ante-litem reports by Metco's engineers establish overwhelmingly that the coatings of the patented powder are the intermetallic nickel aluminide (JA-85, 87), whereas the coatings of the accused powder are essentially nickel. All of the foregoing confirms the trial court's finding that the accused powder did not employ the minimum amount of aluminum required to

form an intermetallic reaction; i.e., at least 10% aluminum by weight and preferably more (JA-83, 84, 85, 89).

Footnote (15) refers to an affidavit filed by the copatentee Dittrich in the Patent Office, in which he specified that a percentage of aluminum of 2.5% produced a successful bond; an ex parte submission not subject to cross-examination or investigation. The statement, moreover, is without relevance to the issue of infringement. Infringement is determined by comparing the composition and function claimed in the patent with the accused powder; the resultant bond is irrelevant (JA-91). Indeed, the accused powder as well as the Metco 5% commercial powder (different from the patented 10% powder) bond extremely well. They bond according to the evidence because of the additional heat; and the allegation that 2.5% of aluminum produced a good bond (if true) proves only that 2.5% aluminum generates sufficient heat from oxidation to produce the bond. Even Metco did not argue at trial that 2.5% aluminum sparsely distributed as a cloud about the nickel will produce an intermetallic reaction. It is significant that no example in the

patent specifies less than 10% by weight of aluminum, and example 31 upon which Metco relies to support claim 14 (i.e., where the aluminum is sparsely distributed as a cloud about the nickel) specifies the amount of 15% by weight of aluminum (JA-84).

This Court states that a 95% nickel-5% aluminum powder achieves the result the patent envisions.\* The statement is technically incorrect and legally irrelevant. The result envisioned in the patent is the nickel aluminide alloy coating because of its special characteristics. The result produced by spraying the accused powder is substantially nickel and not intermetallic nickel aluminide. If the Court is referring to the bonding characteristic, such result is legally irrelevant as infringement is not determined by similarity of result; Maclaren v. B.I.W. Group, Inc., 535 F.2d 1367 (2 Cir. 1976). Moreover, the claims in suit do not claim the characteristic of "self-bonding" (JA-93, 94). The Court refers to footnotes (16) and (17) in support of its conclusion. Footnote (16) refers to testimony of Dr. Grant in which he states that the accused powder

---

\*Slip Opinion, page 6563.

generates the additional heat by oxidation (prior art), and not by the formation of an intermetallic compound (patent). It is not understood how this supports the statement of the Court. More significantly, however, the Court indicates that even if Dr. Grant is correct, "this would not affect the ultimate disposition of the case." The statement is incredulous and manifestly contrary to basic patent law. Surely the Court is not suggesting that Eutectic may not use the admittedly prior art oxidation of aluminum to generate the additional heat. If there is any unassailable axiom in the patent law, it is that the public is free to use what is in the public domain, i.e., the prior art; Great Atlantic & Pacific Tea Co. v. Supermarket Equipment Corp., 340 U.S. 147, 152, 153 (1950).

Moreover, the Diamond Rubber case cited by the Court is misapplied. The quoted portion stands for the proposition that a patentee need not understand the theory of his invention, providing he contributes something new. Dittrich understood full-well the intermetallic heat-generating mechanism he intended to cover in the Metco patent; he also understood

the prior art oxidation heat generating mechanism which he expressly disclaimed from the patent. There is nothing abstruse about either mechanism and both are well understood by the metallurgist.

The Devex case also cited by the Court is equally inapposite. In that case, the experts disagreed about the chemical interactions, but there was no dispute that the patented and accused lubricants had the same components, applied in the same way, and produced the same result. Here there is a sharp dispute in regard to the percentage relationship required for the metals to interact and produce the additional heat from the intermetallic formation; the dispute goes to the essence of the "invention" for which Metco obtained the patent.

10 7

Service of 3 copies of the  
within Petition is hereby  
admitted this 10 day of  
March 19 78

Signed W. K. Kramers, Esq., Dinklage & Sprung

Attorney for Def - App